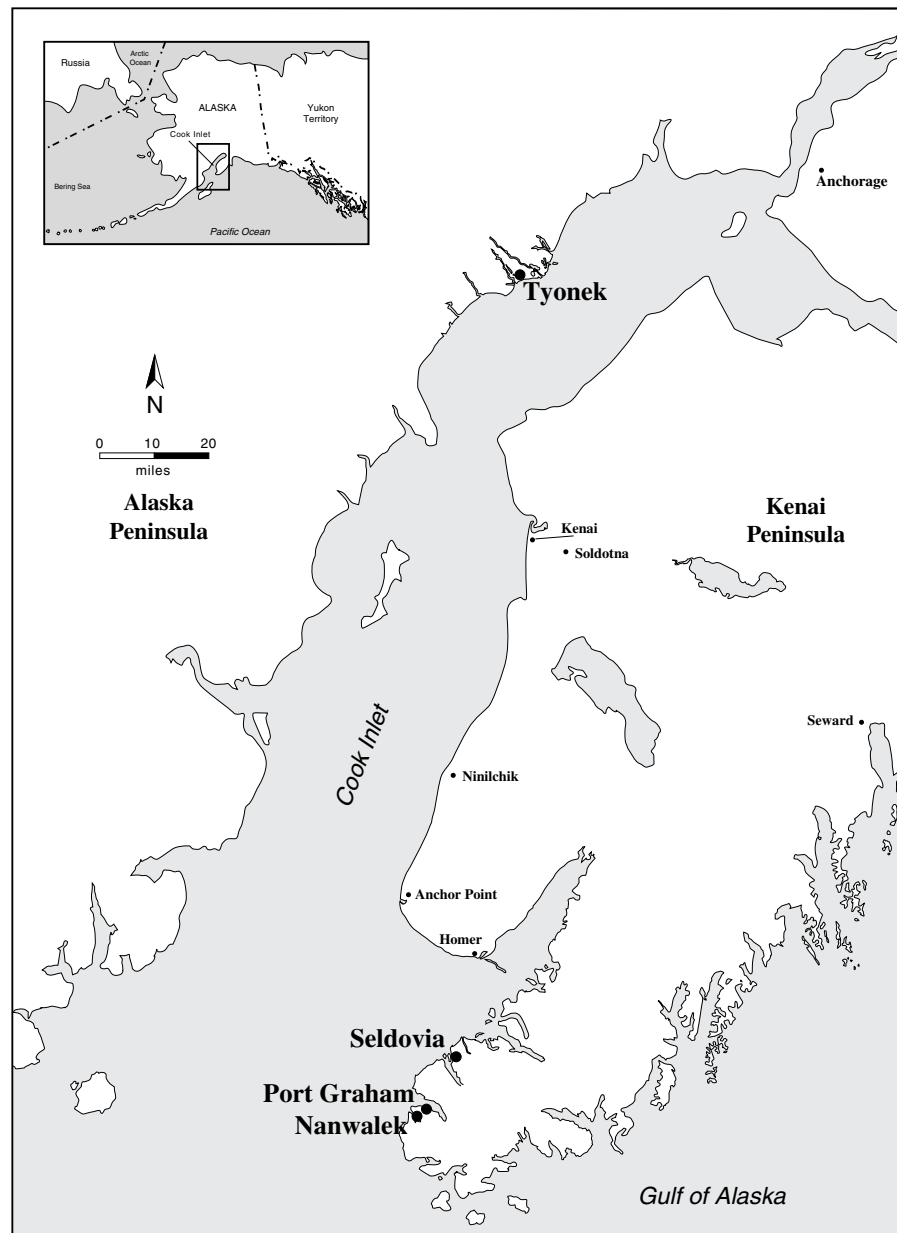




Appendix E

Copy of Nobmann (1997) "Nutritional Benefits of Subsistence Foods"



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NUTRITIONAL BENEFITS OF SUBSISTENCE FOODS

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Submitted to

University of Alaska Anchorage

Institute of Social and Economic Research

3211 Providence Drive

Anchorage, AK 99508-8180

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By

Elizabeth D. Nobmann, Ph.D., M.P.H., R.D.

EDN Nutrition Consulting

3935 Apollo Drive

Anchorage, AK 99504

NUTRITIONAL BENEFITS OF SUBSISTENCE FOODS

EXECUTIVE SUMMARY

Foods from the land and sea have been nourishing Alaska Natives for thousands of years. They have, and they continue to nourish the body, the spirit and the community. Today people are asking, what should they eat? "Is my food safe?" Many non-Native foods are available. What should a person, Native or non-Native, eat? To answer this question, a person needs to know the benefits and the risks, if any, of eating subsistence foods and then weigh this information in terms of his or her personal values.

The Institute of Social and Economic Research (ISER) requested information to assist in developing a comprehensive program that assists individuals and agency personnel in understanding the nutritional aspects of subsistence foods so that they can make informed decisions about the consumption of subsistence foods. The purposes of this report are to 1.) Review and summarize published information about the nutritional benefits of subsistence or Native foods consumed in Alaska; 2.) Identify the gaps in written knowledge about the nutritional benefits, and 3.) Propose ways to address them. The report is intended for administrators in villages and agencies who may deal with subsistence foods. It also is intended for anyone interested in subsistence or Native foods in Alaska and their benefits.

Findings:

Published reports have shown:

Subsistence foods make a substantial contribution to nutritional well being. Over half of the protein, iron, vitamin B-12 and omega-3 fatty acids in the diet of some Alaska Natives comes from subsistence foods.

Subsistence foods have nutritional benefits that make them preferable to many purchased foods. They

are rich in many nutrients, low in fat, and contain more heart-healthy fats and less harmful fats than many non-Native foods.

Alaska Natives eating subsistence foods have lower signs of diabetes and heart disease. The diet of Alaska Natives may explain their lower rates of certain kinds of cancer.

Eating and gathering subsistence foods has positive benefits in avoiding obesity.

Eating and gathering subsistence, or Native, foods contributes to social mental and spiritual well being.

However, there are gaps in knowledge. Information is limited in the following areas:

How does what a person eats affect him?

What foods are eaten in different parts of Alaska? Information is fairly good on what foods are harvested but limited on what is actually eaten.

How much of each food is eaten?

Do people of different ages eat differently?

How are eating practices changing over time and what are the results?

What is the nutrient content of some foods?

Even less information is available on:

What is the nutrient content for many foods for some nutrients?

How do elements in foods protect the body from environmental hazards?

What are the best ways to communicate information that is known?

What are simple tools which individuals could use to interpret scientific findings and make informed decisions about what they eat?

Specific recommendations:

The most important gaps in understanding the nutritional benefits of subsistence foods are in describing what and how much people eat and how this may be related to health.

1. Document what specific foods are eaten and how much is eaten within regions through the seasons. This includes identifying parts of plants and animals consumed and preparation methods. This should be undertaken in collaboration with the local people in regions where there is interest.
2. Compile and distribute nutrient composition information on the most important nutrients in the most consumed foods. Based on their importance to health and the lack of existing information nutrients to investigate include vitamin E, omega-3 fatty acids, monounsaturated, polyunsaturated and saturated fatty acids, vitamin A, beta-carotene, selenium, dietary fiber, calcium, cholesterol, iron, fat, energy, protein, water and carbohydrate.
3. Develop and distribute information on the benefits and clarify any documented risks of consuming specific subsistence foods. Foods of particular interest include salmon, fish other than salmon, sea mammals, livers and kidneys of sea mammals, moose, caribou, and deer, livers and kidneys of land mammals, marine invertebrates and berries.
4. Investigations are needed on the relationships of food and health. This is challenging, as health is

difficult to measure. Disease more often is measured. This is also difficult when there are few cases of the disease in a relatively small population.

5. Basic research is needed on the interactions of nutrients and contaminants and how this effects health. An alternate approach is to measure existing health status first and then compare results with intakes of nutrients and contaminants.

6. Identify and apply the most effective methods of communicating with those that may be interested or need to know about the nutritional benefits and possible risks of eating subsistence foods.

7. There is need for repeating existing findings. Sound, scientific conclusions are based on finding the same results time after time. There is also a need for approaching questions from different angles.

INTRODUCTION

Native foods have been nourishing Alaska Natives for thousands of years. They nourish the body, the spirit and the community. How they nourish is the subject of much research and written reports. It is also the subject of unwritten knowledge and traditional wisdom. This report focuses on the written knowledge. Describing the unwritten knowledge, while commendable, is beyond the scope of this report.

There are three types of information needed to characterize the nutritional benefits of subsistence foods. It is necessary to know what foods are eaten and in what amounts. It is necessary to know what is in each food. Ultimately it is necessary to know what the foods do for you. This report will briefly address these topics and describe where gaps exist in our current knowledge. The project objectives have been broken into several tasks:

Objective 1 The status of existing published knowledge on consumption of subsistence foods in Alaska, their nutritive value, and gaps in knowledge will be described.

Task 1.1 The status of existing published knowledge on consumption of subsistence foods in Alaska will be described.

Task 1.2 The nutritional contribution these foods make will be addressed, including information on the antioxidants, selenium and vitamin E

Task 1.3 Gaps in current knowledge will be defined which will lead to development of a comprehensive program which assists individuals and agency personnel in understanding the nutritional aspects of subsistence foods so that they can make informed decisions about consumption of subsistence foods.

Objective 2 Recommendations on presenting nutritional information in a Contaminants & Subsistence Foods Database will be presented.

METHODS

Existing published information was obtained from a literature search of databases available through the University of Alaska Anchorage Library. Several databases were reviewed: Medline (1966-August 1997), CINAHL (The Nursing and Allied Health Database, (1982-June 1997), HealthSTAR (1975-July 1997), CancerLit (1983-July 1997), Arctic and Antarctic Regions Database (NISC), Dissertation Abstracts on DISC (Jan 1861-March 1997), Alaska Periodical Index (1978-1997), and University of Alaska Library Catalogs. Search topics included: Alaska and subsistence, Alaska and food, Alaska and diet and Alaska and nutrition. Pertinent articles were annotated.

The prototype database under development at ISER was briefly reviewed. Suggestions for presenting nutritional information were generated.

The results of the literature search and my personal knowledge based on twenty-three years of work on.

nutritional issues in Alaska served as the basis for suggesting gaps in knowledge and making recommendations for action.

[go to Findings](#)

FINDINGS

Objective 1: The status of existing published knowledge on consumption of subsistence foods in Alaska, their nutritive value, and gaps in knowledge will be described.

Information that describes quantitative consumption of subsistence food exists from several published reports. (). A variety of related articles exist which describe qualitative consumption of subsistence foods. These references are cited in the Annotated Bibliography. All of these reports describe use of subsistence foods by Alaska Natives. None discussed consumption by non-Natives. This information primarily addresses adults. Thirty-six communities out of more than 200 were surveyed since 1956. Information was found for communities associated with five of twenty regional Native Health Corporations.

In most instances the information was combined and not reported by community. This is done to make results more meaningful. When there are only a few people in a study, any unusual result from even one person, may lead to misleading conclusions about the entire group. Dietary information has many variations. One person's intake varies in amount and variety from day to day. In Alaska there also are seasonal and community differences. Nonetheless, the reports show several benefits of subsistence foods.

Why eat subsistence foods?

Subsistence foods make major contributions to what Alaska Natives eat. Subsistence foods provide energy; energy is vital to life. In the 1950's Eskimos and Indians were getting almost one-half of their energy and much of their nutrient intake from subsistence foods (Heller & Scott, 1967). In the years since, transportation to the villages has improved and there is more food to choose from in grocery stores. Yet in 1992, Eskimos of Gambell were still getting one-fourth of their energy from subsistence foods (Nobmann, 1996). Subsistence foods contribute large amounts of important nutrients

The Division of Subsistence of the Alaska Department of Fish and Game reports large amounts of subsistence foods are harvested (Alaska Department of Fish and Game, 1996). Information from many communities is compiled in the Community Profile Database that reflects what is harvested. While harvest data may give an estimate of what is eaten, actual consumption will vary from what is harvested or brought into the kitchen. Harvest data is something like a food balance sheet, describing the amount of food available per person for a nation or a community. Consumption data identifies what is actually eaten by individuals.

Subsistence foods are nutritious. That Alaska Natives have survived for thousands of years is testament to the fact that subsistence foods available in Alaska were and are capable of fully nourishing people. We know that nutrients provide energy, maintain health, and build and repair the body. In addition, there are elements in food whose importance has yet to be understood. () describes some of the nutritional contributions of subsistence foods.

In addition to providing energy, subsistence foods are rich in many nutrients. Traditional Arctic foods are known to be rich sources of retinol (vitamin A), iron, zinc, copper and essential fats (Kuhnlein, et al, 1995). Among Yupiks of Gambell, over one-half of their protein, iron, vitamin B-12, and omega-3 fatty acids came from subsistence foods. All of the desirable fatty acid known as EPA came from subsistence foods. Protein is vital in building and repairing the body; iron helps turn food into energy; vitamin B-12 helps build blood and nerve cells; and omega-3 fatty acids, including EPA, reduce the risk of heart disease.

It is important to compare subsistence foods with the alternatives, non-subsistence foods. Fish and meat are relatively lean when compared with beef. The fats present in subsistence fish, sea mammals and meats are generally unsaturated fats that are better for heart health than saturated fats found in many non-subsistence foods. Furthermore, fish and sea mammals are the richest sources of omega-3 fatty acids. They have been associated with lower rates of heart disease and other positive health benefits. Subsistence foods do not contain concentrated amounts of carbohydrates that are associated with tooth

decay. Subsistence animals are unusually high in iron. Subsistence foods are low in salt when compared to many foods from the store. Most people in the US get more salt than they need, which may contribute to high blood pressure for some. Some foods from the store are high in sugar, salt and fat, especially saturated fats. These "empty calorie foods" contain little or none of the many nutrients found in concentrated amounts in foods from the land and sea.

Recent attention has focused on lesser-known nutrients such as selenium. Selenium is a trace element found in seafoods, kidney and liver of various animals, whale, and to a lesser extent in other meats and fish. Selenium protects body cells by reducing peroxides; it prevents Keshan Disease, a form of heart disease (NRC, 1989); it is known to counteract the toxic effect of methyl mercury on nerves (Mulvad, 1996). The diet of Siberian Yupik adults in Alaska is generous in selenium, with mean intakes greater than what is recommended for people in the US (Nobmann, 1996). One fourth of their selenium comes from subsistence foods.

The antioxidant effects of selenium and vitamin E may reinforce each other in protecting cell membranes from oxidative damage. They may also enhance metabolism and synthesis of immunoglobulin, or antibodies, and ubiquinone, a part of the energy producing system (Mahan and Arlin, 1992).

Vitamin E, acting as an antioxidant, inhibits the peroxidation of polyunsaturated fatty acids in the low-density lipoprotein (LDL) fats in the blood and blood vessel walls. Peroxidation is thought to be a common step in the development of harmful fatty streaks in atherosclerosis.

Plant oils are the richest sources of vitamin E in the US diet in general as well as in the diet of Siberian Yupiks. Fried bread, pilot bread, and berry agutuk (Eskimo ice cream often made from berries, sugar, and vegetable shortening) were their major sources of Vitamin E. However, subsistence foods also contribute significant vitamin E to the diet. Seal, whale, walrus and caribou tissues were analyzed and found to contain vitamin E in its most active form (Wei Wo and Draper, 1975). The blood of Eskimos, who were eating 45% of their energy from Native foods, was tested in the early 1970's (Wei Wo and Draper, 1975). They had vitamin E levels that were comparable to those in other US adults who consumed a mixed diet.

Subsistence foods are associated with good health. Few studies have been done among Alaskans that compare intake of subsistence foods with physical outcomes (Chen et al., 1995). But among those studies done, eating subsistence foods was related to better health. Eating more subsistence foods was associated with less glucose intolerance. Glucose intolerance is associated with Type II diabetes (Murphy, et al, 1995). In other words subsistence food eaters handled blood sugar better than those who ate less subsistence foods. More specifically, eating seal oil daily and salmon daily was associated with less glucose intolerance (Adler, et al. 1994). In another study, eating fresh bird and foods with alpha-tocopherol (vitamin E) was associated with lower LDL-HDL ratios (Nobmann, 1996). If a person has a high ratio of LDL-HDL in the blood, it is a strong risk factor for coronary heart disease, so having a low LDL-HDL ratio is good.

Cancer is one of the leading causes of death among both Native and non-Native Alaskans (Alaska Department of Health and Social Services, 1997). Low rates of some cancers among Alaskan Inuit may be associated with diet (Lusvardi et al., 1995).

Another important nutritional aspect of subsistence foods is the energy people expend while harvesting them. Maintaining a healthy weight requires burning as much energy as the body takes in. The activities surrounding hunting, fishing, gathering and preserving subsistence foods contribute to an active lifestyle. Physical activity is important in preventing obesity. Obesity is associated with increased risk of heart disease, diabetes, and other medical conditions.

Subsistence foods provide more than nutrients. The process of nourishing involves the body, the mind and the spirit. Perhaps those who live close to the land retain a more integrated sense of nourishment in the broadest sense. At an Alaska-Russia Native People's Health and Social Issues Conference in 1992, 39 attendees called for models that addressed social, emotional, spiritual and

cultural issues as well as physical health (Marshall and Soule, 1993). The former factors are not measured as easily as is physical health, but they are just as important.

The 1989 oil spill from the supertanker, Exxon Valdez, illustrates the relationship of food and psychosocial health (Palankas, et al, 1993). The impact of the Exxon Valdez oil spill on social, cultural and psychological well being of people in affected communities was evaluated by asking people six questions. One of the questions was "Has the oil spill directly affected the hunting, fishing, or gathering activities of any member of this household?" The investigators concluded that there was a significant impact on the psychosocial environment. The more people were exposed to the oil spill through its effects on their food gathering activities (as well as 5 other indicators), the greater the psychosocial impact they experienced.

Subsistence foods make substantial economic contributions to the community (Wolfe and Walker, 1987, Wolfe and Bosworth, 1994). Among other contributions is reducing the monetary cost to feed a family, which takes on greater importance when cash income is low and paying jobs are scarce. When comparing the same foods, the cost of feeding a family with purchased foods in some rural communities is almost twice the cost in Anchorage (Cooperative Extension, June, 1997). People in more remote villages pay even greater amounts.

Subsistence foods make other contributions that are harder to measure but very important. The practice of obtaining subsistence foods gives a person tasty food, exercise, fresh air, a chance to be with family members, and something to share (Mary Gregory, personal communication). These contributions are tangible examples of important cultural and social values.

Plants also are used for medicinal purpose, but a review of literature on medicinal uses is beyond the scope of this paper (For further information, see Fortuine, 1988).

Task 1.3 Gaps in current knowledge will be defined which will lead to development of a comprehensive program which assists individuals and agency personnel in understanding the nutritional aspects of subsistence foods so that they can make informed decisions about consumption of subsistence foods.

Although some information exists (Jackson, 1986; Nielsen, et al, 1996), there is great need for additional information in order to better understand the complex relationships of food and health. Several authors call for better information. Data on the health of Alaska Natives is needed, including investigations into the influence of traditional as well as modern diet (Jackson, 1986). In the ten years since Jackson described these needs, there has been progress in describing nutritional benefits. Yet there is a need for more definitive information. For example, further information about the effects of traditional cooking practices on the pattern of cancer in the Inuit of all circumpolar countries is needed (Nielsen, et al, 1996). Health and risk effects of traditional food need further investigation (Mulvad, et al, 1996), as they relate to ischemic heart disease as well as to other conditions.

Recently the Alaska Department of Health and Social Services released Eat Smart Alaska! Nutrition Related Chronic Disease in Alaska, 1997 Needs Assessment. This baseline needs assessment calls for continuing analyses of and access to nutritional values of traditional/subsistence foods. It calls for collection and analysis of food consumption patterns among adults (average adult daily intake of fat and total calories). Information on nutrition knowledge and behaviors is needed. Surveys such as the Behavioral Risk Factor Surveillance System and Youth Risk Behavior Survey or nutrition-related survey questions to allow for trend analysis should be repeated (Alaska Department of Health and Social Services, 1997). The needs assessment also describes an educational need for increased efforts to promote the identification, gathering, and preparation of traditional and subsistence foods.

People want to know what is in their food. There are numerous needs in order to have a comprehensive source of information about the nutritive value of subsistence foods in Alaska. The Nutrient Value of Alaska Native Foods (Nobmann, 1993) is the most comprehensive table of nutrient values of foods consumed in Alaska. It was compiled from 40 sources. However, numerous nutrient values are missing from the table because the foods haven't been analyzed or existing data have not been evaluated for applicability to Alaska (TABLE 4). For example, only 3% of vitamin E content of subsistence foods are

listed.

A compilation of nutrient composition of foods harvested and consumed in Alaska is needed. It should be readily available, accurate, comprehensive, and updated periodically. Updating the Nutrient Value of Alaska Native Foods could be a starting point. It should include other nutrients such as selenium, omega-3 and omega-6 fatty acids, and beta-carotene. It should include foods that people eat.

Information from other databases and other countries should be considered but only if foods and preparation methods are similar. Values for 40 Alaska Native foods have been incorporated into The Minnesota Nutrition Data System (NDS, Nutrition Coordinating Center, 1993, University of Minnesota, Minneapolis, MN). This was completed to evaluate food intakes as they relate to heart disease and diabetes among Alaska Natives in four Northwest Alaska communities (SOE Ebbesson, Principal Investigator, University of Alaska). An additional 26 foods were identified during data analysis that were not in the NDS food database (Risica, 1997). Appropriate foods had to be substituted.

The Centre for Nutrition and the Environment of Indigenous Peoples (CINE, McGill University, Ste. Anne de Bellevue, Quebec H9X 3V9) conducts extensive analyses of indigenous foods for both nutrient and contaminant levels. However the developers advise their published nutrient values should be used only in specific arctic regions, as values vary with regions (H.V. Kuhnlein, personal communication). Collaboration on the common problems in developing nutrient databases in circumpolar regions would be beneficial.

Laboratory analyses are needed to measure important nutrients in foods where data is lacking. Nutritive values of different organs or portions of animals are needed.

The impact of preparation methods needs to be better understood. For example, Canadian investigators found traditional ooligan grease was ten times richer in omega-3 fatty acids after it was prepared than was the fat of the ooligan fish from which it was prepared (Kuhnlein et al, 1996).

The risks and benefits of specific foods and the interactions of nutrients are important to investigate. The works of Kuhnlein et al (1996) and Chan et al (1996) on ooligan grease offer a good example of this type of investigation. The nutritional contributions of ooligan grease are numerous; it is a rich source of omega-3 fatty acids and vitamin A, and a good source of calcium, iron, and zinc. At the same time the contaminant levels are below guidelines established by Health Canada and Agriculture Canada for arsenic, cadmium, mercury, and lead. The level of persistent organic pollutants also is below Health Canada regulation limits

Specific recommendations The most important next steps are:

1. Update the nutrient database

[Scroll back](#)

- 1.) Quantify what specific foods are consumed within regions through the seasons. This includes identifying parts of plants and animals consumed and preparation methods. This should be undertaken in collaboration with the local people in regions where there is interest. Regions where no data have been collected would be likely locations.
- 2.) Compile and distribute nutrient composition information on the most important nutrients in the most consumed foods. Based on their importance to health and the lack of existing information, nutrients to investigate include vitamin E, omega-3 fatty acids, monounsaturated, polyunsaturated and saturated fatty acids, vitamin A, beta-carotene, selenium, dietary fiber, calcium, cholesterol, iron, fat, energy, protein, water and carbohydrate. Based on existing information (Nobmann, 1989, Risica, 1997), common foods to investigate include different species of smoked and dried salmon, caribou, moose, deer, seal, fat and organs of animals, sheefish, goose, whitefish, reindeer, herring eggs and flesh, blackfish, tomcod, pike, eiderduck, smelt, muskrat, trout, oogruk, devil fish, beluga, flounder, grayling, reindeer, murre, bowhead whale and walrus.
- 3.) Develop and distribute information on the benefits and clarify any documented risks of consuming specific subsistence foods. Foods of particular interest include salmon, fish other than salmon, sea mammals, livers and kidneys of sea mammals, moose, caribou, and deer, livers and kidneys of land mammals, marine invertebrates and berries. A multi media series could be developed "Eating Healthy in Alaska" that describes the benefits of subsistence foods and any documented risks.
- 4.) Investigations are needed on the relationships of food and health. This is challenging, as health is difficult to measure. Disease more often is measured. This also is difficult when there are few cases of the disease in a relatively small population.
- 5.) Basic research is needed on the interactions of nutrients and contaminants and subsequent effects on health. An alternate approach is to measure existing health status first and then compare results with intakes of nutrients and contaminants.
- 6.) Identify and apply the most effective methods of communicating with those that may be interested or need to know about the nutritional benefits and possible risks of eating subsistence foods.

Objective 2 Recommendations on presenting nutritional information in the Contaminants & Subsistence Foods Database will be presented.

The Institute for Social and Economic Research is proposing to develop an easily accessible source for information concerning subsistence resources in Alaska (a computerized database) which includes the positive health effects of subsistence foods as well as information on contaminants, if any.

Specific recommendations

There are several suggestions for presenting nutrient data in a computerized database.

Data from Nutrient Value of Alaska Native Foods (Nobmann, 1993) is the most comprehensive source of information on Alaska Native foods compiled to date and can serve as the basis for nutrient information.

Users unfamiliar with nutrient data need some means of evaluating the significance of the numbers. Nutrient data could be presented in different size fonts representing a qualitative evaluation of the amount; bold or large print indicates the food is a good source of the nutrient.

The user may need background information on the importance or function of various nutrients. Within the table of nutrient values for foods, drop-down windows could be developed for each nutrient stating its key functions. Information in TABLE 5 could be used.

Visually appealing information would be desirable to encourage use. The document "What's in Alaska Foods" could serve as a basis. (See APPENDIX B for examples.) The multi-color bar charts illustrate nutrient contribution of subsistence foods in relation to a person's needs for the day. This material was developed based on requests from health providers throughout Alaska. An explanation for the term Daily Value may be needed.

A more labor intense option is to generate new graphic presentations adapted from other sources, such as bar graphs from Canadian publications. Applicability to Alaska would need to be assured.

Where data are presented in the database, listing number of times foods are eaten by community, explanatory screens should display automatically which describe the details of the study. For example, if "Number of times food eaten" is a column heading, information should be given describing how many person-days of 24-h recalls were collected to obtain this number in each community, and that recalls were collected in each of four seasons.

Testing of the database for ease of use is encouraged for the entire database. People other than the developers might use it for a period of time and make suggestions for improvement (alpha test). Once modifications are incorporated, it could be evaluated by a new group of users who are representative of the intended audience (beta test).

7.) ISER would like to state what communities/regions lack consumption data. If ISER wishes to list those communities for which quantified information on consumption of subsistence foods was not found, they could list communities that do not appear in the references cited in . However, not all references describe village specific consumption. Four of the seven references report findings for the villages combined. In anticipation of collecting additional information, identification of regions lacking information may be more cost-effective and more useful for certain purposes. If qualitative descriptions of subsistence food consumption are to be included, additional references should be considered (Anderson, et al, 1977; Halderson, 1991; and references cited by McMillan, 1982, should be reviewed further. The latter reference lists citations prior to 1982 however.).

8.) ISER also would like to incorporate the data from the reports on consumption of subsistence foods in a single spreadsheet. The information collected here provides a beginning, but there are several limitations. The major drawback to establishing such a database is the lack of uniform methods in the investigations. The investigations had a variety of purposes. Data were collected in different ways; e.g. open ended responses in 24-h recalls vs. predetermined foods in food-frequency questionnaires vs. food calendars. Consumption was reported in different ways; e.g. number of times a food was consumed, or units of various nutrients supplied by local foods, or in ounces. Subsistence foods were defined with varying degrees of precision; e.g. a category might be "local meat" or it might be more specific such as seal meat. Data were most often aggregated rather than reported by individual community. These limitations suggest that a spreadsheet would have limited information and numerous explanatory notes. The only features commonly listed might be the community where data were collected, and the names of some foods reported as consumed.

ISER would like to have copies of reports listed in for reproduction and distribution. The regulations governing copyright and reproduction of each document would be the governing factors for this process. Some documents are lengthy:

Heller and Scott, (1967) is 281 pages. The document is out of print but two copies are available in the UAA Library.

Nobmann, E.A.D. (1996) is a 305-page thesis. It is available in the UAF Library and copies may be obtained through UMI, 300 North Zeeb Road, P.O. Box 1346 Ann Arbor MI 48106-1346.

Thomas (1982) is 312 pages. It is available on microfiche in the UAA Library. The other articles were printed in periodical journals.

CONCLUSION

Numerous nutritional benefits from subsistence foods have been reported. They contribute a significant proportion of energy to the diets of Alaska Natives. Where intake has been assessed, subsistence foods contribute more than half the protein, iron, vitamin B-12, and omega-3 fatty acids, especially EPA. Eating more subsistence foods has been associated with positive health effects among Alaska Natives. Health indicators related to diabetes and heart disease, which are significant health problems, are lower among those eating more traditional, subsistence foods. Several reports theorize that certain kinds of cancer may be lower among Inuit because of their diet. Subsistence foods provide economic and sociocultural benefits, which provide "nourishment" in the broader sense.

While information presented supports the many contributions of subsistence foods, needs for additional information remain. In Alaska we need: 1.) Quantified consumption data within regions, that includes both subsistence and non-subsistence foods, 2.) Nutrient composition data for the most commonly consumed foods and nutrients of current interest, 3.) Consumer-friendly risk-benefit information on subsistence foods, 4.) Basic research on nutrient effects on human health and contaminants among other health concerns, 5.) Application of effective techniques to communicating nutritional benefits and possible risks of eating subsistence foods.

NUTRITIONAL BENEFITS OF SUBSISTENCE FOODS:

ANNOTATED BIBLIOGRAPHY

APPENDICES

APPENDIX A: Definitions used in this Report

APPENDIX A: Definitions used in this Report

Native foods. Foods harvested from the land or sea, or combinations of those foods that are commonly consumed by Alaska Natives. They are wild foods that may be prepared in distinct or traditional ways.

Native Health Corporation. Any of twenty Regional Alaska Native Health Corporations that provide health and social services for Alaska Natives. They include:

Aleutian Pribilof Island Association Inc.,
Bristol Bay Area Health Corporation,
Copper River Native Health Corporation,
Chugachmiut,
Eastern Aleutian Tribes, Inc.,
Kodiak Area Native Health Corporation,
Maniilaq Association,
Metlakatla Indian Community,
Mt Sanford Tribal Consortium,
Native Village of Eklutna,
Native Village of Tyonek,
Ninilchik Village Tradition Council,
North Pacific Rim,
North Slope Borough,
Norton Sound Health Corporation,
Seldovia Village Tribe,
Southcentral Foundation,
Southeast Alaska Regional Health Consortium,
Tanana Chiefs, Inc.,
Valdez Native Tribe, and
Yukon Kuskokwim Native Health Corporation.
Nutrient. A nutritious substance; a nutritive ingredient of food.

Nutrition. The sum of the processes by which an animal or plant absorbs, or takes in and utilizes, food substances; that which nourishes.

Nourish. To furnish or sustain with nutriment; to feed; foster; maintain; support.

Subsistence foods. Wild foods which contribute to subsisting, i.e. existing, maintenance. Used here to mean foods harvested from the land or sea in Alaska for non-commercial purposes.

Traditional foods. Synonym for Native foods.

Vitamin C in Selected Foods (Lowbush Salmonberries, Willow Leaves, Orange Juice, Sourdock, Lowbush Cranberries, Highbush Salmonberries)

Vitamin A in Selected Raw Foods

Iron in Selected Foods

Calcium in Selected Foods

Percent Daily Value of Nutrients in Moose (Roasted) and Beef and Pork Frankfurters

Percent Saturated and Unsaturated Fat in Selected Foods

Percent Daily Value of Nutrients in Ringed Seal Flesh

Percent Daily Value of Nutrients in King Salmon

TABLE 1
REPORTS THAT QUANTIFY* CONSUMPTION OF SUBSISTENCE FOODS IN
ALASKA

REFERENCE YEAR	PARTICIPANTS	AGE	LOCATION	FOODS
Nobmann (1996)	1992 65 Siberian Yupiks	40-87yrs.	Gambell	30+ Native foods, 113+ non-Native foods
Murphy, et al (1995)	1987- 895 Eskimos 1988	>=20 yrs.	Summary of 15 Yukon-Kuskokwim communities: Akiak, Akiachuk, Anvik, Bethel, Eek, Grayling, Holy Cross, Kasigluk, Kwethluk, Napakiak, Napaskiak, Nunapitchuk, Shageluk, Tuluksak, Tuntutuliak	moose/caribou, seal/walrus, salmon/fish, birds, beaver, mouse food, Eskimo potato, wild greens, berries, seal oil
	229 Athabascans >=20 yrs.			
Adler, et al (1994)	1987- 556 Eskimos 1988	>=40 yrs.	Summary of 15 Yukon-Kuskokwim communities	salmon, seal oil
	110 Athabaskans >=40 yrs.			
Nobmann, (1992)	1987- 351 Alaska Natives 1988	21-60 yrs	Summary of 11 communities: Anchorage, Bethel, Dillingham, Kake, Kotzebue, Kwigillingok, Mountain Village, Pedro Bay, Pilot Point, Selawik, Sitka	Fish, Agutuk and 18 non-Native foods
Nobmann (1989)	1987- 359 Alaska Natives 1988	>=40 yrs.	Summary of 11 communities: Anchorage, Bethel, Dillingham, Kake, Kotzebue, Kwigillingok, Mountain Village, Pedro Bay, Pilot Point, Selawik, Sitka	number of times 33 Native foods and 87 non-Native foods eaten
Thomas (1982?)	1980 10 Alaska	All ages	Shaktoolik	weights of 18 Native foods and non-Native foods
Heller and Scott	1956-61 4840 diet records	All ages	Summaries of 11 villages: Akiak, Allakaket, Hooper Bay, Huslia, Kasigluk, Napaskiak, Newtok, Noatak, Point Hope, Shishmaref, Shungnak	Narrative of 20+ species by season, summaries of food groups e.g., meat, fish

*Methods of quantification vary, including number of times a food is eaten, proportion of nutrients from a food or food group, etc.

Table 2
Nutritive Value of Subsistence Foods Consumed in Alaska

Subsistence Food Group	Nutrient Supplied	Nutrient Function**
Fish	Protein	Important for growth, maintaining every cell, making enzymes, providing energy.
	Fat	Provides concentrated energy, is part of every cell, transports fat soluble vitamins.
	Omega-3 fatty acids	Increase clearance of very low density lipoproteins (VLDL) from the plasma, decrease production of triglycerides and apolipoprotein B (main parts of VLDL) which may reduce incidence of coronary heart disease; improve symptoms of rheumatoid arthritis.
Fish Liver Oils	Vitamin A	Is a key part of the eye's ability to see at night. Helps keep skin healthy and helps the body resist infection. May help prevent some types of cancer.
	Vitamin D	Helps body use calcium and phosphorus.
Fish with Bones	Calcium	Builds and maintains strong bones and teeth. May help prevent high blood pressure and certain types of cancer. Regulates nerve impulses, muscle contractions and heart rhythm.
Large Land Mammals e.g. moose, caribou, deer	Protein	Important for growth, maintaining every cell, making enzymes, providing energy.
	Iron	Is the part of the blood cell that carries oxygen to the cells, increases resistance to infection, helps the body turn food into energy
Livers	Vitamin A	Is a key part of the eye's ability to see at night. Helps keep skin healthy and helps the body resist infection. May help prevent some types of cancer.
Small land mammals e.g., beaver, muskrat	Protein	Important for growth, maintaining every cell, making enzymes, providing energy.
	Iron	Is the part of the blood cell that carries oxygen to the cells, increases resistance to infection, helps the body turn food into energy.
Marine mammals, e.g., whale, beluga, walrus, seal	Protein	Important for growth, maintaining every cell, making enzymes, providing energy.
	Iron	Is the part of the blood cell that carries oxygen to the cells, increases resistance to infection, helps the body turn food into energy.
	α-tocopherol (Vitamin E)	Antioxidant that protects cell membranes from damage.
	Omega-3 fatty acids	Increase clearance of very low density lipoproteins (VLDL) from the plasma, decrease production of triglycerides and apolipoprotein B (main parts of VLDL) which may reduce incidence of coronary heart disease;

improve symptoms of rheumatoid arthritis.

Muktuk (skin and subcutan- eous fat of whale)	Monounsaturated fats	Can reduce plasma cholesterol and low-density lipoprotein when substituted for saturated fat; may protect LDL from oxidation.
	Omega-3 fatty acids	Increase clearance of very low density lipoproteins (VLDL) from the plasma, decrease production of triglycerides and apolipoprotein B (main parts of VLDL) which may reduce incidence of coronary heart disease; improve symptoms of rheumatoid arthritis.
Livers	Vitamin A	Is a key part of the eye's ability to see at night. Helps keep skin healthy and helps the body resist infection. May help prevent some types of cancer.
Birds and eggs	Protein	Important for growth, maintaining every cell, making enzymes, providing energy.
Marine Inverte- brates	Protein	Important for growth, maintaining every cell, making enzymes, providing energy.
	Iron	Is the part of the blood cell that carries oxygen to the cells, increases resistance to infection, helps the body turn food into energy.
Plants and Berries	Vitamin A	Is a key part of the eye's ability to see at night. Helps keep skin healthy and helps the body resist infection. May help prevent some types of cancer.
	Vitamin C	Helps wounds heal. Helps the nervous system function normally, May help prevent cancer.
	Fiber	Is the non-digestible portion of food that helps maintain regularity and keeps the digestive tract healthy. Some types of fiber may help prevent cancer and lower blood cholesterol.

** Adapted from Jensen and Nobmann, 1994; National Dairy Council, 1993; IHS Nutrition and Dietetics Training Program, 1992; National Research Council, 1989; and Mahan and Arlin, 1992.

Table 3
The Positive Health Effects of Consuming Subsistence Foods in Alaska

Condition	Documented Effect	Theoretical Effect
Non-insulin dependent diabetes mellitus (NIDDM)	Alaska Natives with normal blood sugar had higher intake frequencies of seal oil and lower intakes of beef/pork and white bread than those with glucose intolerance (Murphy, et al 1995).	
Glucose intolerance	Alaska Natives who ate both daily seal oil and daily salmon had a lower prevalence of glucose intolerance than those who ate them less-than-daily (Adler, et al 1994).	
Cancer		Fresh fruits and vegetables, dietary fiber, beta-carotene, vitamins C and E, selenium and calcium have been reported as protective against carcinogenesis in a variety of sites, e.g. larynx, lung, esophagus, stomach, colon, rectum, breast and cervix (Nielse
Breast cancer		Omega-3 fatty acids, found in fish and marine mammals, has been suggested as reducing the risk of breast cancer (Nielsen, 1996).
Breast cancer		Breast cancer incidence, while increasing among Circumpolar Inuit, is about half what could be expected. This could be explained by the Inuit diet (not a high fat intake among Canadian Inuit, and more n-3 than n-6 fatty acids) and other lifestyle factors
Prostate cancer		Dietary factors (less animal fat than at least one non-Inuit population) may account for the low risk of prostate cancer among Inuit of Greenland, Canada, Alaska and Russia. Diet may determine risk of prostate cancer through its influence on sex hormone
Ischemic heart disease		The prevalence of atherosclerotic lesions in the aortas of Alaska Natives was consistently lower than in those of non-Natives, which may be due to high dietary intake of omega-3 fatty acids (Newman et al, 1993).

LDL-HDL ratio	Siberian Yupiks who reported consuming greater amounts of a-tocopherol (Vitamin E) and fresh bird had lower LDL-HDL ratios, which is desirable. A high LDL-HDL ratio is considered one of the strongest determinants of risk from coronary heart disease (Nobmann)
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Dental caries	Dental caries rates were very low in skeletal remains of early Alaska Natives who ate no refined sugars and starches (Costa, 1980).
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